

THE MINERAL INDUSTRY OF NORWAY

By Chin S. Kuo

Norway has abundant energy resources with rich offshore hydrocarbon deposits. The growth of its oil and gas sector significantly contributed to the country's economy. Together with mining and quarrying, the sectors accounted for 12.3% of the gross domestic product (GDP). In 2003, the GDP grew by only 0.6% compared with 1% in 2002. Per capita GDP in purchasing power parity, however, was the second highest in Europe with \$47,316 (International Monetary Fund, 2003§¹). As a major international oil producer, Norway had an output capacity of 3 million barrels per day (Mbbbl/d). Gas and liquefied natural gas production was also substantial. All the gas and most of the oil produced were exported. Oil and gas exports accounted for 56% of total exports. Hydropower provided nearly all the country's electricity (U.S. Department of State, 2004§).

The reorganization of the Petroleum Directorate under the Ministry of Petroleum and Energy has been proposed by the Government. Its safety and environment section will become the Petroleum Inspectorate and will report to the Ministry of Labor and Government Administration effective January 1, 2004. The resource section of the Petroleum Directorate will continue its work as a directorate reporting to the Ministry of Petroleum and Energy (Rigzone.com, 2003b§).

The Petroleum Directorate reported that Norway's identified resources of oil and gas off its western coast decreased by 7% compared with those of 2002. The country's oil reserves were about 5 billion cubic meters, and its gas reserves, 6.5 billion cubic meters. Norway was the world's third leading oil exporter after Saudi Arabia and Russia. It exported one-half of its oil output and one-fourth of its recoverable gas produced in the North Sea (Alexander's Gas & Oil Connections, 2003d§).

Commodity Review

Metals

Hydro Aluminium ANS had a 540,000-metric-ton-per-year (t/yr) aluminum smelting capacity in Norway. In 2003, it planned to phase out 190,000 t/yr of its capacity that used outdated Soederberg technology. About 600 workers out of a total of 3,050 would be affected. By yearend 2006, 50,000 t/yr of capacity at the Ardal smelter and 20,000 t/yr of capacity at the Hoyanger smelter would be shut down. At the Karmoy smelter, 120,000 t/yr of capacity was to be closed down by the end of 2009 (Mining Journal, 2003a).

Construction of 14 new furnace groups was complete, but only 10 were in operation at Elkem Aluminium ANS's Mosjoen aluminum smelter owing to higher hydropower costs. The final four furnace groups should begin production in April of 2003. The plant's primary aluminum capacity had increased to 165,000 t/yr from 122,000 t/yr since the completion of construction work. Elkem A/S owned 50% of Elkem Aluminium, and Alcoa Inc. of the United States, the other 50% (Metal Bulletin, 2003).

Store Norske Spitsbergen Kulkompani A/S, which was a State-owned sole coal mining company, identified a gold prospect on Svalbard Island and planned to begin drilling in 2004. Preliminary tests showed an 11-kilometer (km)-long gold-bearing zone that had varying amounts of gold. The area is located 20 km north of Ny Aalesund on Svalbard (Reuters, 2003§).

Blackstone Ventures Inc. of Canada was involved in nickel exploration in Norway. The company would be able to earn a 60% interest in each of the Vakkerlien and Espedalen projects by spending \$1.75 million during 4 years. Vakkerlien's delineated resource was estimated to be 400,000 metric tons at 1% nickel and 0.4% copper. Espedalen contained a differentiated mafic intrusion with disseminated and massive sulfide mineralization with copper and nickel (Mining Journal, 2003b).

Companhia Vale do Rio Doce (CVRD) of Brazil signed a contract to acquire 100% of the capital of Elkem Rana A/S (a wholly owned subsidiary of Elkem) for \$17.6 million. Elkem Rana's plant at Mo i Rana produced ferrochrome until June 2002. The plant, which had two furnaces and a sinter unit, would be converted to produce manganese alloys in July 2003 with an investment of \$10 million. The plant's production capacity was 110,000 t/yr of ferroalloys, which included ferrosilicon manganese and ferromanganese high-carbon alloys. The deal facilitated CVRD's plan to expand its ferroalloys business in continental Europe and strengthened its position in the world ferroalloys market (Companhia Vale do Rio Doce, 2003).

In the absence of a significant improvement in market conditions of silicon metal, however, Elkem restarted two of its silicon metal furnaces in the first quarter to offset reduced output from its U.S. operation. While fully operating its Rana Metal ferrosilicon plant, FESIL ASA continued to restrict silicon metal production. Both furnaces at FESIL's Lilleby Metal plant were out of operation, and three of the four furnaces at its Hola Metal plant were shut down in 2003 (Metal Bulletin Research, 2003).

Outokumpu Oyj of Finland will replace the old roasting production process by direct leaching at its Odda zinc plant in Norway. The \$95 million project was expected to be completed in fall 2004. The direct leaching process of wider quality-range zinc concentrates would improve the efficiency of production. The modernization would increase the concentrate feed capacity by 10%. The Odda plant produced 150,000 t/yr of zinc metal (Outokumpu Oyj, 2003).

¹References that include a section mark (§) are found in the Internet References Cited section.

Industrial Minerals

Norcem A/S awarded KHD Humboldt Wedag AG of Germany the contract to provide engineering and equipment for the modification of cement kiln line No. VI in its Brevik plant. This will enable the use of a wider range of alternative fuels combined with increased energy efficiency and reduced carbon dioxide emissions. The modification was to be finished by mid-2004 (Cement News, 2003).

Skaland Grafitverk AS, which was a flake graphite operation on the island of Senja in northern Norway, stopped production in January while the operation worked off its stockpiles. Skaland was a joint venture among James Durrans Ltd. (45%) of the United Kingdom, Georg H. Luh GmbH (45%) of Germany, and Berg Industri Selskap AS (10%). Skaland produced 8,500 t/yr of processed graphite with a carbon content of from 85% to 98%. A new deposit of graphite-bearing ore was identified and could extend the mine life by another 50 years. The deposit contained a high percentage of large flake graphite and a carbon content of 28% (Industrial Minerals, 2003).

Mineral Fuels

The Ministry of Petroleum and Energy offered major oil companies new exploration licenses in the North Sea. Norsk Hydro Produksjon A/S, Exxon Mobil Corp. of the United States, and DONG A/S of Denmark were offered two operatorships each, while Statoil ASA, Agip, DNO ASA, Pertra AS, and RWE Dea AG were granted one operatorship each in the 2003 North Sea licensing round. In this round, 14 companies nominated 43 blocks as interesting by 2 or more companies (Alexander's Gas & Oil Connections, 2003b§).

Statoil sold interests that it held in two production licenses to Paladin Resources Norge AS. Its holdings of 30% and 25% in production licenses 143 and 239, respectively, were at the southern end of the Norwegian continental shelf on the boundary with the United Kingdom's North Sea sector. Statoil's strategy was to concentrate its efforts on other defined core areas (Dow Jones Business News, 2003§). Meanwhile, Statoil was to purchase two production licenses for the North Sea from ExxonMobil that were 50% of production license 29B, which is located north of the Sleipner West Field, and 15% of production license 241, which is located south of Sleipner West.

DONG acquired Amerada Hess Corp.'s 20% interest in the Norwegian production licenses 122 and 122B, which also included Statoil (50%), Agip (20%), and ExxonMobil (10%). The Marulk gas discovery was made in the licenses, but there were no plans to develop it. The acquisition of the interest was to secure access to the resources in the longer term (Rigzone.com, 2003a§).

Ruhrgas AG (a subsidiary of E.ON of Germany) acquired a 15% interest in Njord Field in the North Sea from ConocoPhillips Company. Njord Field contained reserves that could total as much as 10 billion cubic meters of gas and 51 million barrels (Mbbbl) of oil. Oil production began in 1997, and gas extraction would begin in 2 to 3 years. Other shareholders in the field were Norsk Hydro, Gaz de France, and ExxonMobil each with 20% and Paladin, Petoro AS, and OER Oil AS with smaller stakes (Rigzone.com, 2003c§).

ConocoPhillips and its partners' plan for their Ekofisk Field was that an additional 190 Mbbbl of oil equivalent would be recovered, and production would increase by 70,000 barrels per day (bbl/d) at peak and start in the third quarter of 2005. Investment of \$1.16 billion would include a new production platform and 25 new wells (Petroleum Economist, 2003b).

Fortum Corp. of Finland closed the sale of its Fortum Petroleum AS and its Norwegian exploration and production business to ENI International BV. The transaction completed the divestment of Fortum's noncore exploration and production holdings (Hugin Online, 2003§).

Statoil's oil and gas production would be 1.06 Mbbbl/d of oil equivalent in 2003 compared with 1.07 Mbbbl/d in 2002. The decrease would result from a lag between the slowing down in production at its mature fields and the increase in output at its new fields. Its 2004 goal would be 1 Mbbbl/d from the Norwegian continental shelf and 120,000 bbl/d from its international operations (Alexander's Gas & Oil Connections, 2003e§). Statoil's production from the Alpha North Gasfield would start in October 2004. The estimated reserves were 1.21 billion cubic meters of gas and 32 Mbbbl of condensate. The company was the operator with a 49.5% interest.

Statoil began oil production from its Vigdis Field extension in the North Sea. The extension could recover 50 Mbbbl of oil from the field. Startup production by one well was expected to be 12,000 bbl/d, and peak output from three wells, 57,000 bbl/d. Six wells would eventually be drilled, developed, and produced. Statoil became the field operator in 2003 (Oil & Gas Journal, 2003b).

Production of Norsk Hydro's Tune gas/condensate field was 3 billion cubic meters per year from four wells. Reserves were estimated to be 22.9 billion cubic meters of gas and 36.5 Mbbbl of condensate. Cost of the development was \$435 million. Tune interests were Norsk Hydro (40%), Petoro (40%), and Total SA (20%) (Petroleum Economist, 2003a). Norsk Hydro's \$200 million development and operation plan of the Oseberg South was expected in October 2004 with a peak production of 21,000 bbl/d. Recoverable oil reserves were estimated to be 24 Mbbbl.

Norsk Hydro started oil production from its Grane Field at a water depth of 120 meters (m) 185 km west of Haugesund in September. Output would reach the planned level of 210,000 bbl/d in the first half of 2005. It was estimated that 700 Mbbbl of oil could be recovered from Grane. Oil from Grane was transported through a 212-km pipeline to Norsk Hydro's terminal at Stura in Oygarden. The company was the operator with a 38% interest (Alexander's Gas & Oil Connections, 2003a§).

Norway may soon become a leading producer of natural gas as well as a leading oil exporter. In 10 years, the production of natural gas in volume could be greater than that of crude oil. Gas production was currently (2003) 25% of Statoil's total production on the Norwegian shelf. A new gas pipeline from Norway to the United Kingdom would be necessary to handle the additional gas sales to the United Kingdom (Alexander's Gas & Oil Connections, 2003c§).

Norsk Hydro's development of the Ormen Lange Field in the Norwegian Sea was expected to be completed by October 2007. The field is located 140 km west of Kristiansund, Norway, under 1,000 m of water. Ormen Lange could increase Norwegian gas exports by 25%, thus making Norway the world's second leading gas exporter after Russia. Reserves were estimated to be 375 billion cubic meters of gas and 22 million cubic meters of condensate. Gas production was expected to peak at 20 billion cubic meters per year for a life of 30 to 40 years (Oil & Gas Journal, 2003a).

Outlook

Norway was expected to increase its oil and gas production despite a decrease in its identified resources of oil and gas in 2003. The production increase was expected to come from the Ekofisk, Fjord, and Grane Fields, and the Vigdis Field extension during the next 2 to 3 years. The country, which was already a leading exporter of oil, was expected to become a leading producer of gas. Exploration for oil and gas was expected to be active after the 2003 North Sea licensing round.

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Major Sources of Information

Norwegian Geological Survey
P.O. Box 3006 Lade
7002 Trondheim, Norway
Ministry of Petroleum and Energy
P.O. Box 8148 Dep
0033 Oslo, Norway

TABLE 1
NORWAY: PRODUCTION OF MINERAL COMMODITIES ¹

(Metric tons unless otherwise specified)

Commodity	1999	2000	2001	2002	2003
METALS					
Aluminum:					
Primary	1,020,215	1,025,676	1,067,000	1,095,500	1,192,400
Secondary	178,313	254,600 ^r	223,900 ^r	271,000 ^r	256,800
Cadmium, smelter	211	298	372 ^r	209	331
Cobalt:					
Mine output, Co content ^c	100	100	100	100	100
Metal, refined	4,009	3,433	3,314 ^r	3,994	4,556
Copper, metal, refined, primary and secondary	33,262	27,000 ^e	26,700	30,500	35,900
Iron and steel:					
Iron ore and concentrate, Fe content thousand tons	355	369	340 ^e	350 ^e	350 ^e
Metal: do.					
Pig iron ^e do.	60	60	60	80 ^r	90
Ferroalloys: ^e					
Ferrochromium do.	160	154 ²	83 ²	61 ²	60
Ferromanganese do.	235	235	240	240	245
Ferrosilicomanganese do.	230	230	230	230	230
Ferrosilicon, 75% basis do.	460	460	450	390 ^r	350
Silicon metal do.	100	100	100	105	100
Other do.	15	15	15	15	15
Total do.	1,200	1,190	1,120	1,040 ^r	1,000
Steel, crude do.	611	620	635	694	698
Semimanufactures, rolled do.	458	573	623	630 ^e	635 ^e
Magnesium, primary	40,800	41,400	36,000 ^e	10,000 ^e	--
Nickel:					
Mine output:					
Concentrate ^e	21,000	18,000	18,000	12,000	--
Ni content	2,965	2,538	2,529	1,700	--
Metal, primary	74,137	58,679	68,220	68,500	77,200
Platinum-group metals ^{e, 3} kilograms	1,000	1,000	1,000	1,000	1,000
Titanium: ^e					
Ilmenite concentrate thousand tons	580 ²	750	750	750	800
TiO ₂ content do.	257 ²	340	340	340	345
Zinc, metal, primary	132,600	125,800	129,300	137,300	135,500
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	1,827	1,851	1,870 ^e	1,850 ^e	1,860 ^e
Feldspar ^e	72,777 ²	75,000	73,000	75,000	74,000
Graphite ^e	2,500	2,500	2,500	2,400	2,400
Lime, hydrated, quicklime ^e thousand tons	100	100	100	100	100
Mica, flake ^e	2,500	2,500	2,500	2,600	2,600
Nepheline, syenite ^e thousand tons	305 ²	300	310	310	300
Nitrogen, N content of ammonia do.	122	334	323	330	354
Olivine sand ^e do.	3,162 ²	3,200	3,300	3,200	3,100
Stone, crushed: ^e					
Dolomite	893 ²	900	900	900	850
Limestone	6,915 ²	7,000	7,500	7,400	7,200
Quartz and quartzite	1,314 ²	1,300	1,500	1,400	1,500
Sulfur, byproduct:					
Metallurgical	97	92	105	102	100
Petroleum ^e	12	18	18	18	18
Total ^e	109	110	123	120	118
Talc, soapstone, steatite ^c	26	27	27	28	28

See footnotes at end of table.

TABLE 1--Continued
NORWAY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		1999	2000	2001	2002	2003
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades ^e	thousand tons	328 ²	330	320	310	300
Gas, natural, marketed ^{e, 4}	million cubic meters	43,000	42,000	41,000	40,000	40,000
Peat, for agricultural use ^e	do.	30	30	30	30	30
Petroleum: ^e						
Crude ⁵	thousand 42-gallon barrels	1,100,000	1,000,000	1,000,000	1,050,000	1,100,000
Natural gas liquids	do.	42,000	41,000	41,000	41,000	42,000
Refinery products:						
Naphtha	do.	26,000	26,000	27,000	27,000	27,000
Gasoline	do.	25,000	26,000	26,000	26,000	27,000
Kerosene	do.	9,000	9,000	9,000	9,000	9,000
Distillate fuel oil	do.	45,000	46,000	46,000	46,000	47,000
Residual fuel oil	do.	12,000	12,000	12,000	12,000	12,000
Other products	do.	4,000	4,000	4,500	5,000	5,000
Refinery fuel and losses	do.	4,000	4,000	4,000	5,000	5,000
Total	do.	125,000	127,000	129,000	130,000	132,000

^eEstimated; estimated data are rounded to no more than three significant digits; may not add to total shown. ^rRevised. -- Zero.

¹Table includes data available through August 26, 2004.

²Reported figure.

³Data represent exports.

⁴Reported as total methane sales.

⁵Excluding natural gas liquids.

TABLE 2
NORWAY: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners		Location of main facilities	Annual capacity
Aluminum	Hydro Aluminium ANS (Norsk Hydro A/S, 70%)		Smelters at Ardal, Hoyanger, Karmoy, and Sunndalsora	600
Do.	do.		Plant at Holmestrand	90
Do.	Elkem Aluminium ANS (Elkem A/S, 50%, and Alcoa Inc., 50%)		Smelters at Farsund and Mosjoen	250
Do.	Sor-Norge Aluminium A/S (Alusuisse Group, 50%, and Hydro Aluminium ANS, 49%)		Smelter at Odda	50
Cadmium	Norzink A/S (Outokumpu Oyj, 100%)		Smelter at Eitrheimsneset	0.3
Cement	Norcem A/S		Plants at Brevik and Kjøpsvik	2,150
Coal	Store Norske Spitsbergen Kulkompani A/S		Mines at Longyearbyen and Svea	450
Cobalt	Nikkelverk A/S (Falconbridge Nickel Mines Ltd., 100%)		Smelter at Kristiansand	3
Copper:				
Ore, Cu content	Nikkel og Olivin A/S (Outokumpu Oyj, 100%)		Mine at Narvik	1
Metal	Nikkelverk A/S (Falconbridge Nickel Ltd., 100%)		Smelter at Kristiansand	40
Dolomite	Franzefoss Bruk A/S		Mine at Ballagen	350
Do.	Norwegian Holding A/S		Mines at Hammerfall, Logavlen, and Kvitblikk	500
Feldspar	Franzefoss Bruk A/S		Mine at Lillesand	100
Ferroalloys	Elkem Salten (Elkem A/S, 100%)		Ferrosilicon plant at Straumen	90
Do.	Elkem Bjølvfossen (Elkem A/S, 100%)		Ferrosilicon plant at Alvik	60
Do.	Elkem Thamshavn (Elkem A/S, 100%)		Ferrosilicon plant at Orkanger	60
Do.	Finnfjord Smelteverk A/S, Rana Metal (FESIL ASA, 100%)		Ferrosilicon plant at Mo i Rana	110
Do.	A/S Hafslung Metal (FESIL ASA, 100%)		Ferrosilicon plant at Sarpsborg	75
Do.	Ila og Lilleby Smelteverk (FESIL ASA, 100%)		Ferrosilicon plant at Finnsnes	60
Do.	Oye Smelteverk (Tinfos Jernverk A/S, 100%)		Silicomanganese plant at Kvinesdal	235
Iron, metal	Ulstein Jernstoperi A/S		Hordvikneset	10
Iron ore	Rana Gruber A/S (Norsk Jernverk Holding A/S, 100%)		Mine at Mo i Rana	2,000
Do.	Artic Bulk Minerals A/S		Mine and plant at Kirkenes	1,500
Lime	Hylla Kalkverk (Nikolai Bruch A/S, 100%)		Verdal/Trondheim Mine and plant	80
Do.	A/S Norsk Jernverk		Plant at Mo i Rana	48
Do.	Ardal og Sunndal Verk A/S		More og Romsdal Mine at Surnadal	20
Do.	Breivik Kalkverk A/S		Alesund Mine at Larsnes	20
Do.	Mjøndalen Kalkfabrik		Plant at Asen/Drammen	7
Limestone	Norcem A/S		Dalen, Bjørntvedt, and Kjøpsvik Mines	1,600
Do.	Vardelskalk A/S (Franzefoss Burk A/S, 100%)		Sandvika Mine	800
Do.	Breivik Kalkverk A/S		Visnes and Glaerum Mines	500
Magnesium	Norsk Hydro A/S (Government, 51%)		Plants at Porsgrunn and Sauda	50
Manganese, alloys	Eramet SA		do.	500
Natural gas	million cubic meters	Den Norske Stats Oljeselskap A/S	Gama, Gullfaks, Sleipner Ost, and Statfjord Fields	12,270
Do.	do.	Phillips Petroleum Company Norway	Ekofisk Field	9,900
Do.	do.	Elf Petroleum Norge A/S	Frigg, Heimdal, and Ost-Frigg Fields	5,750
Do.	do.	Norsk Hydro Produksjon A/S	Troll-Oseberg Field	2,600
Do.	do.	BP Petroleum Development of Norway	Gyda and Ula Fields	1,040
Do.	do.	Esso Norge A/S	Odin Field	1,000
Do.	do.	Amoco Norway A/S	Hod and Valhall Fields	910
Nepheline syenite	North Cape Mineral A/S (Unimin Corp., 84%)		Mine at Stjernøy	350
Nickel:				
Ore, Ni content	Nikkel og Olivin A/S (Outokumpu Oyj, 100%)		Mine at Narvik	3
Do.	Titania A/S (Kronos Norge A/S, 100%)		Mine at Tellnes	0.5
Metal	Nikkelverk A/S (Falconbridge Nickel Mines Ltd., 100%)		Smelter at Kristiansand	85
Olivine	A/S Olivin		Aheim Mine and plant	2,500
Do.	do.		Stranda Mine and plant	300
Do.	Franzefoss Bruk A/S		Lefdal Mine at Bryggja	500

TABLE 2--Continued
NORWAY: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum	42-gallon barrels per day	Den Norske Stats Oljeselskap A/S	Gullfaks, Statfjord, Tommeliten, and Veslefrikk Fields	1,069,300
Do.	do.	Norsk Hydro Produksjon A/S	Brage, Mime, and Oseberg Fields	566,200
Do.	do.	Phillips Petroleum Company Norway	Ekofisk Field	237,500
Do.	do.	Saga Petroleum A/S	Snorre Field	170,000
Do.	do.	BP Petroleum Development of Norway	Gyda and Ula Fields	155,000
Do.	do.	A/S Norske Shell	Draugen Field	90,000
Do.	do.	ExxonMobil Refining & Supply Co.	Slagen Refinery	110,000
Do.	do.	Statoil Mongstad	Mongstad Refinery	200,000
Pyrite		Folldal Verk A/S (Norsulfid A/S, 100%)	Mine at Hjerkind	10
Quartzite		Elkem Tana (Elkem A/S, 100%)	Mine at Tana	540
Do.		Elkem Marnes (Elkem A/S, 100%)	Mine at Sandhornoy	200
Do.		Vatnet Kvarts A/S	Mine at Nordland	150
Do.		Snekkevik Kvartsbrudd	Mine at Kragero	110
Silicon metal		Lilleby Metall A/S (FESIL ASA, 100%)	Plant at Trondheim	9
Steel		Fundia AB (Norsk Jenverk, 50%; Rautaruukki Group, 50%)	Plants at Christiania, Mandal Stal, Mo i Rana, and Spigerverk	600
Talc		A/S Norwegian Talc (Pluess-Staufer AG, 51%)	Mine/plant at Altermark/Knarrevik and Framfjord	90
Do.		Kvam Minerals A/S	Mine/plant at Kvam	6
Titanium, concentrate		Titania A/S (Kronos Norge A/S, 100%)	Mine at Tellnes	800
Zinc, metal		Norzik A/S (Outokumpu Oyj, 100%)	Smelter at Odda	150